Exploring the effect of terrorist attacks on markets

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Abstract
The aim of this paper is to explore the determinants of terrorist unexpected events and if these events can affect economic markets. Based on the existing literature and the methodologies already been used, our purpose is to draw some attention to specific events, which may create losses to investors or even to countries. Specifically, after a thoughtful consideration of the existing relative studies, we discuss a number of empirical findings concerning the main determinants of terrorism. In particular, religions and especially fanatics is the most common determinant followed by the economic perspective of an attack. We show that the more democratic and developed countries are inclined to decrease the spread on the returns. Relying on these empirical findings, we discuss the implied policy implications and the necessary further research.

Keywords: Terrorism; market reactions; investors; event study; religions; regimes.

JEL Codes: G14; H12; H56; O57.

1. Introduction

Terrorism is not a new phenomenon (Carter et al., 1998). Economic analysis and consequences of terrorism have attracted significant and continuous research interest. Apart from human life losses, the victims of terrorist attacks suffer from fear of brutal violence and immense number of injuries, which may lead to a number of associated indirect costs. These costs are not easily countable and refer to immense amount of resources necessary to protect against terrorism or to the instant harms and losses of property and capital stock caused by a terrorist attack. Terrorist actions may negatively affect many economic and social activities like among others flows of FDI, tourism, and economic uncertainty and stock markets with reductions in firms' expected profits.

As it is well known and accepted, rational investors are by their nature risk averters. This means that they prefer safe investments that will not put their capital into risk. On the other hand, what characterizes markets is uncertainty. The reasoning that high risks lead to high returns and basically to high profits is what predominates in either capital or bond markets. Therefore, hedging is the tool that comes to fill the gap between risk adverse investors and markets' uncertainty. In that way, investors can secure themselves for changes in interest rates, exchange rates or even share price changes by using future or option products.

However, the question is how they will secure their investments against unexpected events. The main issue in that case is that no one can predict the exact time or place or whether an unexpected event is going to occur or not. Many people assume that some events like weather outbreaks are predictable while there are some cases such as terrorist attacks that are not probably predictable. Among others, Kollias et al. (2011a) using event study and GARCH models explore the influence of the terrorist attacks in Madrid (11th March 2004) and in London (7th July 2005) and the effect of these attacks on equity

sectors. They find significant negative abnormal returns only in Spain but with a much quicker market rebound in London compared to the Spanish markets where attackers were not suicide bombers. Similarly, Kollias et al. (2011b) considered whether market reaction (depending on either targets' type or attacks' perpetrators) to terrorism has been altered diachronically and if market size and its maturity establish reactions. They consider the London and Athens stock exchange capitalization markets and using an event study methodology and conditional volatility models they find empirical evidence that size and maturity together with specific attributes of terrorist incidents are probable determinants of markets' reactions.

In this paper, we focus on whether there is a linkage between terrorist attacks and specific determinants such as geographic position, religion, and government system and of course the period. Specifically, we consider the theoretical and empirical framework of this specific issue. Following the occurrence of these events, market reactions are expected to be negative due to the unforeseen happenings causing opposite effects on firms and economies.

The outline of the paper is as follows. Section 2 presents relative previous research studies examining the purposes of these papers, the applied methodologies and their main empirical findings. Section 3 presents the data used in our research effort together with their graphical and statistical presentations. Section 4 presents an event study and discusses the main findings on this analysis. Finally, Section 5 concludes the paper and proposes further research steps.

2. Literature Review

2.1 The Purpose

Tavares (2004), apart from the examination of stock returns, investigates the main determinants causing terrorism. The risk of terrorism is higher in comparison to other catastrophes, because is driven by both intelligence and intent. Intelligence is a factor excluded from natural unexpected catastrophes and intent is a factor excluded from industrial disasters. This makes terrorist attacks more dangerous compared to other catastrophes (Major, 2002). However, that situation may become even worse when the main weapon of terrorism is any kind of biological agent. A terrorist may use a pathogen due to the fact that this element may not be easily detected as a potential threat. As a consequence, the pathogen will have the adequate time to spread so as to be presented as a natural disease and not as a bioterrorist attack (Dembek, 2005). Since no one can accurately answer the question whether each disease was caused naturally or was a bioterrorist attack, the available data for bioterrorism is in fact narrow.

From another perspective, Frey et al. (2004) investigated the terrorist attacks and the different aspects that have influenced not only the market but also the associated economic impact. Their analysis provides evidence that a terrorist attack may have an outcome to eight different aspects, such as tourism, investments as well as foreign direct investments, savings and consumption, foreign trade, urban economy, national income and growth and of course stock markets. This analysis provides an integrated view of the outcomes that a terrorist attack may have.

Considering the purpose per region, the terrorist attacks on the USA embassies in Kenya and Tanzania inspired Carter et al. (1998) in their research. Although USA supports the belief that they are prepared for any terrorist attack, because terrorism for them is a serious matter, Carter et al (1998) proved that USA is not prepared enough to

face such events especially when the events have as a target the government, services or embassies.

On these lines, the terrorist attack that inspired a great amount of researchers is the 11th of September 2001, which shocked the whole world. Charles and Darné (2006) examined whether this attack had a temporary or a more permanent consequence due to the huge economic result that has been caused. On the other hand, Bhattarai et al. (2005) investigated the results of the same terrorist attack on September 11, but not in the USA, which is the region mainly affected but Nepal, which has as a main industry the adventure tourism, and the main source of tourist is from developed countries and especially from the United States.

Krueger and Malečková (2003) are also inspired by the September 11 but they tried to examine the event from the educational and economic perspectives. Their purpose was to suggest if there is any linkage to an attack with the educational level of the perpetrators including also in their research the economic viewpoint by analysing the perpetrators' and not the victims' economic status.

Hausken (2016), based on the 11/9/2001 terrorist attack in the USA and following the proposed methodology used by Steward and Mueller (2013), establishes a cost benefit analysis of terrorist attack, in which three main costs are included. The first element refers to the human cost, including any suicide attack, the second element refers to the economic cost and it deals with the required funds for each attack, while the third element refers to the influence cost for the targets, which is considered as benefit for the assaulter. Initially, the model is introducing a time discount factor, as well as a risk parameter, which includes all possible risk cases such as risk aversion, risk neutrality and risk seeking. In addition, the generalization of the models permits a multiple stakeholders' impact to the terrorist organizations, which leads to different weights in each analysis.

Rosoff and John (2009) used a simulation model with terrorist perspectives' proxies, while Shubik and Zelinsky (2003) introduced a new metric relationship. This relationship represented the linkage between the target and the assaulter and was called *Terrorist Damage Exchange Rate*. Buesa et al. (2007) studied the aftermath of the March 11 2004 terrorist attack in Madrid by evaluating the direct economic costs, while considering that human catastrophic consequences will follow. In an attempt to assess various counterterrorism procedures, Sandler et al. (2009, 2011) calculated the values of lives and casualties based on an average terrorist attack. On the other hand, Brandt and Sandler (2010) clarified the way terrorists justify the costs and benefits by adjusting the targets.

Consider the purpose per decade we may say that although authors attempted to include previous research based on per year attacks, nothing was fount. Therefore, to our knowledge, there is no research trying to conclude whether the frequency of attacks has significantly changed in recent years compared to the past.

Similarly and in terms of the analysis per religion, Jones (2006) focused his research specifically on religious terrorist attacks. His research is a theoretical psychoanalytic approach and attempts to analyse the main psychological perspectives that underlie the attacks guided by religious groups. He also tried to search if there are specific religious groups that are more prone to commit such crimes.

Another usual question is why terrorism occurs. More specifically, a number of researchers wonder which system of government is the most dangerous as a target. There is a great conflict on whether democracy tends to be the main target for a terrorist attack both from the inside of the country and also from the outside the borders. Brynjar and Skjølberg (2000) raised this question and attempted to answer it.

2.2 Methodologies used in the empirical applications

Event study analysis is the most commonly used methodology in investigating unexpected events (Eckbo et al, 1990; Prabhala, 1997; Maloney and Mulherin, 2002; Chen and Siems, 2004; Gaspar et al. 2005; Karolyi and Martell, 2006; Charles and Darné, 2006; Walker et al., 2006; Ambec and Lanoie, 2008; Arin et al., 2008; Brounrn and Derwall, 2010; Carpentier and Suret, 2015). What differs between these studies is the range of the event window. Some researchers use a 10-days range of the event window basically when they want to examine the immediate and short-term impact (Charles and Darné, 2006) while some other prefer a longer range of the event window such as Carpentier and Suret (2015) who extended the event window up to a year due to the fact that investors have the power to pressure the management in the long-run so they do not prefer to sell over the night.

Apart from event study analysis that has already been mentioned, Bollerslev (1986) introduced the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, which appeared not to be the best approach due to the fact that the estimated residuals of that model continue to have excess kurtosis as proved by Baillie and Bollerslev (1989) and Teräsvirta (1996). Many researchers have attempted to give an explanation to that problem concluding that GARCH models are not able to apprehend outliers (Balke and Fomby, 1994; Fiorentini and Maravall, 1996). For the outlier detection, Charles and Darné (2006) applied ARIMA models. What is also mentioned in this paper are two methods that are commonly used by researchers. Time Series Regression with ARIMA Noise, Missing Observations and Outliers (TRAMO) used by Franses and Haldrup (1994), Lo and Chan (2000), Tolvi (2001), Charles (2004), Darné and Diebolt (2004) is the first method while Bradley and Jansen (1995) used methods like autoregressive, moving average, ARMA and ARIMA described by Tsay (1998).

Tavares (2004) determined the main factors influencing terrorism. For that reason, he applied a simple linear regression where the explanatory variables were all those factors that, based on the researcher, could influence the terrorist attacks. In a different manner, Major (2002) included game theory, search theory and specialized areas on statistics in his analysis due to the fact that he proposed we need more than a probability when discussing terrorism because of factors such as intelligence and intent.

Corrado (1989) developed a non-parametric methodology due to non-normality. Cam (2006), Ramiah et al. (2007) and Hallahan et al. (2016) used this methodology. Obviously, something that is unexpected cannot follow the normal distribution. Hamilton and Hamilton (1983), in one of the initial papers using dynamic models, suggested a class of stochastic models in order to prove there are arguments on the terrorism and further impacts. Moving forward, Cauley and Im (1988) exerted the intervention analysis, which is actually an interrupted time series analysis to examine how effective the security measures can be. Based on these, Enders and Sandler (1993) upgraded this approach by adding in the analysis the Vector Autoregressive Models.

Paté-Cornell and Guikema (2002), Frey et al. (2004), Dembek (2005) and Okuyama (2007) introduced various advanced techniques. Paté-Cornell and Guikema (2002) based their analysis on different scenarios. They have used opt system analysis and probabilistic approach. Dembek (2005) also used a similar method with a variety of scenarios. Both of these researches have investigated bioterrorism. Paté-Cornell and Guikema (2002) emphasize that when using probabilistic approaches to bioterrorism the expected biases and errors due to the limited data availability are minimized. On the other hand, Dembek (2005) applied the probable scenarios as an attempt to make future predictions about the biological terrorist attacks.

Moving forward, Frey et al. (2004) initially analyzed the *traditional methods* used in order to calculate the costs of terrorism and then proposed a new method that is not only based on valuation and market. The new method takes into consideration the *life satisfaction* dimension. Specifically, the two traditional methods are the *stated preference* and the *revealed preference methods*. When using the prior method, researchers are usually operating the *contingent valuation method* while for the revealed preference method the commonly used one is the *hedonic market* approach. The new approach (Frey et al., 2004) is, as already mentioned, based on life satisfaction and aims to value the psychological impact on humans and not just the economic and market impacts.

On the top of the advanced methods are those mentioned in Okuyama (2007). This paper analyzes the benefits and drawbacks of each method. The *Input–Output* (I/O) *method* is the most commonly used when examining terrorist attacks and natural disasters. Similarly, with *Social Accounting Matrices (SAM) method*, I/O aims to provide upper bounds when analyzing the economic impact of the terrorist attacks and natural disasters. In contrast with I/O, *Computable General Equilibrium (CGE)* is non-linear model that can estimate a long-term equilibrium; however, it is a method generally underestimating the economic impact of these events. General *Econometric Models* may provide stochastic estimates as well as the ability to make future forecast but the main drawback is the fact that a massive dataset is required in order to have accurate estimations.

Based on Okuyama (2007) there are two aspects that may influence the estimations and even lead to models that are more specific. These two aspects are *time* and *geographical space.* The time of these events in duration and consequences may range from 30 seconds to few months, in a worst-case scenario. On the other hand, most – if not all - of the economic indices are reported in an annual base. When using a static

approach, the estimation cannot capture the significance of the event due to the short time span of that disaster, which usually leads to insignificant total impact estimations in the end. In order to make those models applicable to each case, researchers made some improvements such as adding lags to consider time. Improvements have been made to all models. The dynamic version of I/O is an approach that includes lags, while *Regional Econometric Input-Output Model (REIM)* is a continuous time formulation. Due to the fact that the CGE approach is not the best choice, because of the static factor, a dynamic CGE approach has been also established. When considering time, last but not least is the *Sequential Interindustry Model (SIM),* which is used when the economic indices are reported in a quarterly base. By using I/O with the SIM modification, researchers have the ability to determine short-run estimation. The SIM approach is the most appropriate for short-run estimations, however is not flexible enough.

Concerning the geographical space it is expected that any kind of disaster will affect not only the region where the event takes place but probably the whole country or even more (Okuyama, 2007). For that reason, the space dimension should also be taken into consideration and one of the most appropriate solutions is to use the *Spatial Computable General Equilibrium (SCGE)* approach. What is also commonly used is the market efficiency by Fama (1998) and the Fama and French three-factor model (1993).

2.3 The empirical findings

The empirical results of studies on terrorist attacks are quite significant. Hallahan et al. (2016), relying on the 11th of September 2001, showed that systematic risk has mainly increased due to that attack whereas there was no change due to similar attacks. Carter et al. (1998) investigated the terrorist attacks on USA embassies concluding that although USA believe terrorist attack is a serious matter, US was not prepared enough in order to tackle such a threat of catastrophic terrorism.

In terms of religions, Jones (2006) mentioned that all religious terrorists emphasize they are tackling an apocalyptic battle with demonic forces. The terrorists' purpose is not only to divide the world into good and evil but also to purify the world. The linkage that has been fount between religion and terrorism is the violence of sacrificial killing and/or apocalyptic purification.

In terms of results per system of government, Brynjar and Skjolberg (2000) concluded that there is a complex relationship between democracy and terrorism. More specifically, they mention that although the democratic countries are a great target for the terrorists, the semi-democratic countries or countries in democratic transition are those with the most events occurring.

The main contradiction is made on the level of democracy and wealth. Karolyi and Martell (2006) stated that terrorist attacks on richer and more democratic countries led to a greater negative market reaction compared to the poorer and less democratic ones. Here comes the contradiction by Tavares (2004) who claimed that the democratic countries face small market reactions.

Concerning the education level and based on the findings in Russell and Miller (1983), the majority of perpetrators are usually well educated from high-ranking universities and probably Masters Degree holders. So, the belief that terrorism is a situation caused by uneducated or less educated people cannot be proved from this paper. This statement can be well connected to Hamilton and Hamilton (1983) who ended on results proving that the further impact is generated to less well-educated countries. On the other hand Taylor (1998) mentioned that the social background as well as the educational level of the participants cannot be proved to be determinants of a terrorist attack.

In terms of the results per developed/ developing countries and based on the findings by Russell and Miller (1983) the majority of perpetrators usually come from the middle or even the upper classes in the respective nations or areas.

3 Empirical Analysis

3.1 Data, graphical and statistical presentations

The database used in our paper contains all terrorist attacks for a time span of 45 years (1970 – 2014)[1] and the events recorded in an intraday base. However, the initial dataset does not contain any record for the year 1993. After a great research, no official records have found since 2015, so the results do not depict the latest events that took place in Asia and Europe.

The University of Maryland's dataset includes almost all the important variables such as the date and time of the event, the country and city of the attack, the attack and the target type as well as the number of fatalities and injuries of each attack. However, we have decided to enrich database by including the region[2] of each country as well as religion[3], system of government[4], educational level[5] and whether the target is a developed or developing country.

After collecting all the relevant variables and in order to extract information about the regularity of an event occurring under specific conditions their frequencies were calculated. In order words, our aim was to categorize the various events by taking into

[1] The source of the main data is the library of University of Maryland, Global Terrorism Database: https://www.start.umd.edu/gtd/

[2] The source of the Regions is the United Nations website revised in 31/10/2013: http://unstats.un.org/unsd/methods/m49/m49regin.htm

[3] The source of the Religion per country is the CIA's World Fact Book: https://www.cia.gov/library/publications/the-world-factbook/fields/2122.html

[4] The source of the System of Government is the CIA's World Fact Book: https://www.cia.gov/library/publications/the-world-factbook/fields/2128.html

[5] The source of the educational level of each country is the literacy indicator by World Bank: http://data.worldbank.org/indicator/SE.ADT.1524.LT.ZS

consideration all explanatory variables collected. These results will help us understand the main motivations that lead to a terrorist attack occurrence. The final attempt will be to mark the most dangerous targets to help investors protect themselves and their portfolios from risky investments that can cause great losses due to a terrorist attack. Various maps and different kinds of graphs will allow us to visualise these outcomes.

3.2 Results & Discussion

In this section, we will consider the results per continent and region, decade, religion, regime, educational level and for developed and developing countries. Map 1 shows graphically the frequencies per continent of terrorist attacks while Table 1 presents the terrorist attacks and the associated fatalities and injuries per continent and region.

Specifically, in Map 1a we may first see the frequencies of terrorist attacks occurred in North America since 1970 where there were only 69 attacks in Canada compared with the 2,646 attacks in United States. Moreover, the two other countries that belong to North America (Greenland and Bermuda) have no attacks during the whole time span.

As can be seen in Table 1, in North America there are 2,715 terrorist attacks, both in the USA and in Canada causing in total 3,861 fatalities and 3,069 injuries. Compared to the following findings, it is obvious that all the numbers appear to be low for such a crowed, multicultural, and multinational region. In this area an event that raised great attention has occurred. This event is the 11th of September terrorist attack that force researchers to start taking into consideration terrorism and its perspectives.

The situation is aggravated in Central and South America where the number of the terrorist events reaches the 11,836 attacks in those 45 years, which is almost 4.5 times higher than that of North America (Table 1). The huge numbers of fatalities and injured people indicate the great leftover of those attacks where the fatalities sum to a total

number, which is more than two times higher than injuries (Table 1). Moreover, what is obvious in Map 1b is that the main targets are Peru and Colombia, which reach the 6,075 and 7,942 events respectively. Compared to the North America, Central and South America is facing a greater amount of terrorist attacks, however, not that much attention.

In the European case (Map 1c), terrorist attacks are smoothly spread in the whole continent and the United Kingdom is the target where the most events occurred and more specifically the total number of events in those 45 years equals to 4,881 attacks. The recorded number of fatalities in Europe is much less (almost 1/5) compared to the ones in Central and South America but there is not such a great difference between the injured people on those two different cases, where Europe reaches a slightly higher number.[6] What is important to mention is that, in the European region we came across with many different religions, systems of government, economic and educational levels, which makes it a great filed of conflicts due to the diversification.

When the discussion comes to Asia, the scene changes to the worst-case scenario where the terrorist attacks are flourishing and reaching the highest level of terrorist attacks worldwide in just one and only country. Iraq is the most smitten target worldwide (Map 1d). With 16,023 terrorist attacks in its history, Iraq counts the most killed and injured people in its population, 49,760 and 100,997 respectively.

Even in a continent level, Asia reaches the highest number in all three cases. The total number of terrorist attacks is 73,324 causing 167,235 and 289,593 fatalities and injuries respectively (Table 1). Other countries been seriously affected are Afghanistan, Pakistan and India (Map 1d). The total attacks for those three countries are 7,765, 11,522

[6] It has to be emphasized again that since January 2015, there are no yet available officially recorded attacks and as result the recent unfortunate events are not mentioned in our paper. If we could include these events in the European case then this would have change a lot the map as there is a sharp increase in terrorist attacks occurring in Europe this last one and a half year.

and 9,069 attacks respectively. Having that in mind, we can figure out the Pakistan is the second most smitten country in Asia.

Compared to Asia, the African continent has suffered less. This may be easily justified by the total number of events occurred in Africa, which equals to 16,630, almost the same number with the attacks that took place just in Iraq. That is, one Asian country has suffered as much as the whole of the African continent. The number of fatalities in Africa equals to 68,207 of its population and the injured people are 50,715, giving a ratio of 0.5 compared to those in Iraq (Table 1e). The countries affected more in Africa are Algeria with 2,704 attacks, Somalia with 2,482 attacks, Nigeria with 2,251 attacks and South Africa with 1,969 attacks (Map 1e).

Oceania is the least affected continent in a worldwide base. The levels of terrorist attacks are not comparable to any other as only 239 terrorist events occurred in the whole continent over the last 45 years with 144 fatalities and 235 injured people (Table 1). As it is obvious in Map 1f, Australia is the most smitten one with just 81 attacks in its history since 1970.

Examining the attacks per region is not enough as maps display the results in an aggregated number for the whole time span. What is also important to know is whether the events tend to be more often the latest years or if the case seems to follow a normal path of attacks. As shown in Figure 1, the first decade was the less harmful with 9,837 terrorist attacks. The next decade (1980 – 1989) is the worst decade of the history with 31,165 terrorist events, which gradually decreased in the next 2 decades. However, we are currently in the last decade, but still in the half of it (2010 – 2014) and the recorded terrorist attacks until now have exceeded all previous records. Considering the latest terrorist events since 2015 the current decade is to be expected as the worst.

Table 1: Total number of terrorist attacks and associated fatalities and injuries

Continents and Regions	Terrorist attacks	Fatalities	Injured people
North America Total	2,715	3,861	3,069
Central America	10,342	28,923	9,052
South America	18,453	28,532	16,316
Central & South America Total	28,795	57,455	25,368
Eastern Europe	3,319	5,777	9,173
Northern Europe	5,295	3,619	5,857
Southern Europe	6,921	2,593	7,914
Western Europe	4,251	607	3,484
Europe Total	19,786	12,596	26,428
Central Asia	253	400	1,332
Eastern Asia	758	1,000	9,075
Southern Asia	33,929	78,829	73,467
South-Eastern Asia	9,313	13,539	22,644
Western Asia	29,071	73,467	140,297
Asia Total	73,324	167,235	289,593
Eastern Africa	4,713	22,900	19,288
Middle Africa	1,190	8,766	4,715
Northern Africa	5,665	17,472	15,039
Southern Africa	2,161	2,918	4,947
Western Africa	2,901	16,151	6,726
Africa Total	16,630	68,207	50,715
Australia & New Zealand	99	18	83
Melanesia	136	126	129
Micronesia	0	0	0
Polynesia	4	0	13
Oceania Total	239	144	235

Proportionally to the increase of terrorist attacks, there is a steady increase in both fatalities and injuries (Figure 1) and as it can be seen the increase in injuries is sharper than the increase in fatalities. The cause to that increase may be the advance in technology and the fact that everyone can now have access to weapons that may cause thousands of fatalities (Tucker, 1999).

Map 1: Frequency maps of terrorist attacks per continent

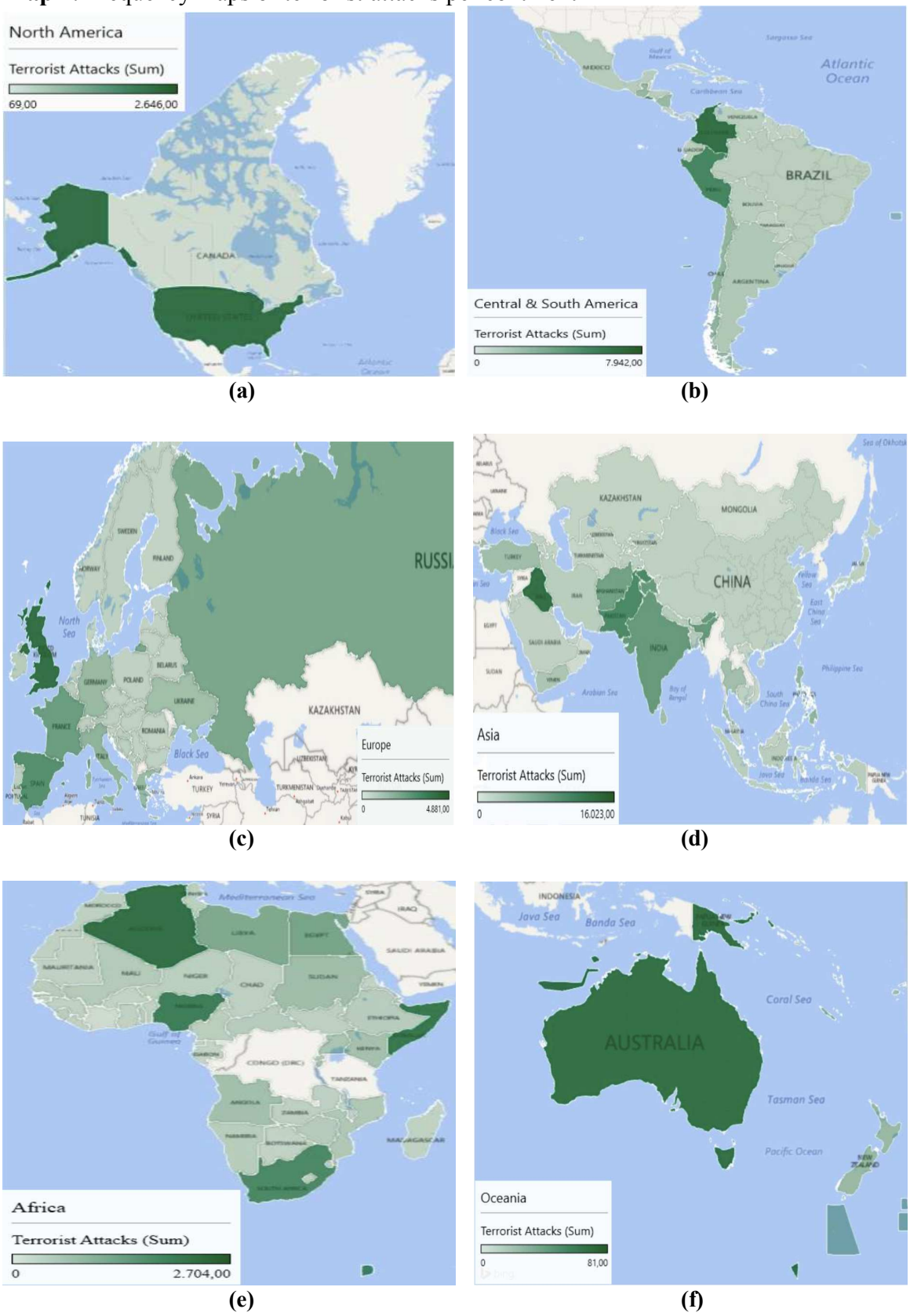
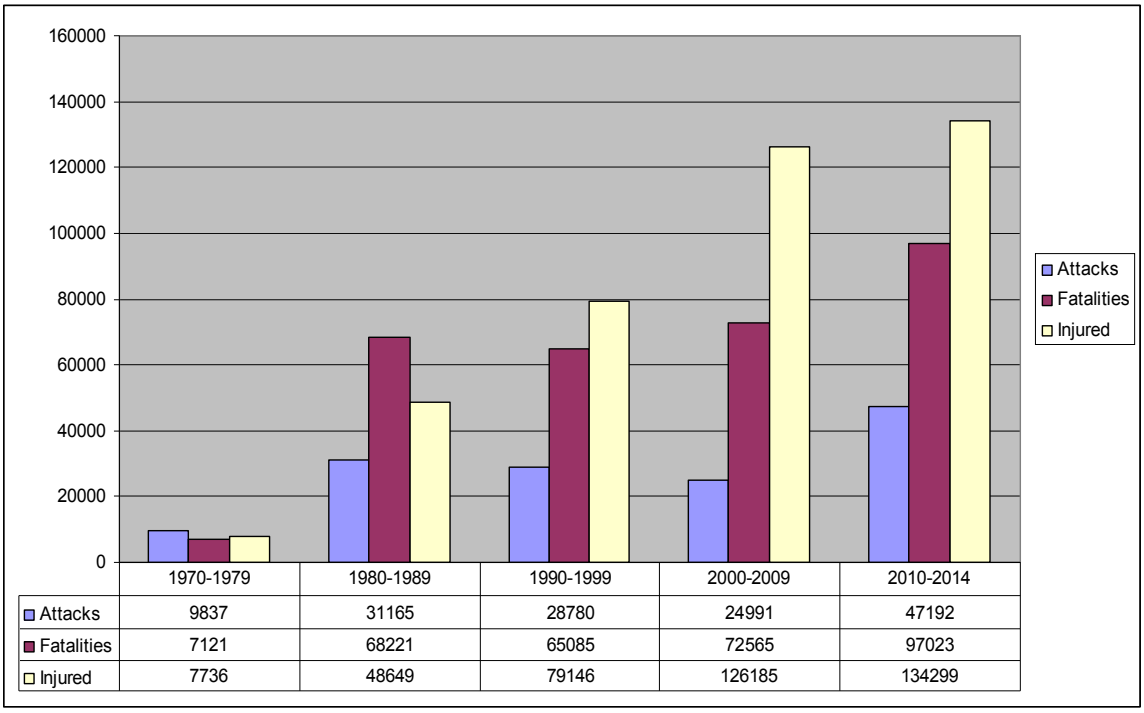


Figure 1: Attacks, fatalities and injuries per decade



	1970-1979	1980-1989	1990-1999	2000-2009	2010-2014
Attacks	9837	31165	28780	24991	47192
Fatalities	7121	68221	65085	72565	97023
Injured	7736	48649	79146	126185	134299

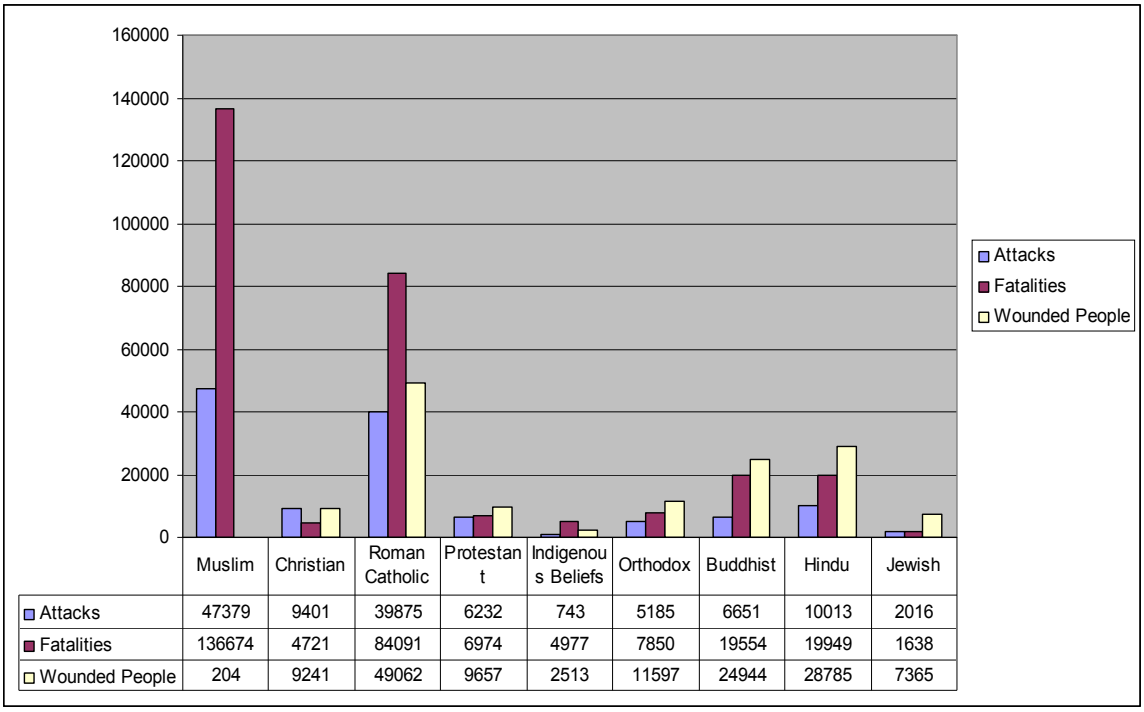
Another driven factor for the terrorist attacks is the differentiation in religions. We consider religions as one of the most important factors and thus we examine in detail this factor in our analysis. Figure 2 displays religions, which appeared to concentrate a great number of events, while Table 2 is a concise presentation of the rest of religions with the total number of terrorist attacks, fatalities as well as injuries in each case. Muslims seem to be the main target with 47,379 terrorist attacks, which, however, can be explained by the fact that it is the highest religion population worldwide.

The next more targeted religion is the Roman Catholic with 39,875 attacks over the last 45 years. Based on Figure 2, Muslim has the greatest number in fatalities, while Roman Catholics have the greatest number in injured people. However, what is obvious is that the most well known religions are those, which have the most terrorist events as well. One reason could be the fact that these religions are spread all over the world in contrast with some other religions that are found in specific countries.

To our knowledge, none of the existing papers has mentioned specific religions that raise great attention. What has been done till now is to mention specific groups of

religious terrorists. Moreover, what we believe we should mention is that the most common and widespread religions are those which faced the greatest fatalities. The reason to that may be the high-populated religions compared to the less common ones such as Anglican or Ekalesian Niue.

Figure 2: Attacks per Religion



	Muslim	Christian	Roman Catholic	Protestant	Indigenous Beliefs	Orthodox	Buddhist	Hindu	Jewish
Attacks	47379	9401	39875	6232	743	5185	6651	10013	2016
Fatalities	136674	4721	84091	6974	4977	7850	19554	19949	1638
Wounded People	204	9241	49062	9657	2513	11597	24944	28785	7365

Table 2: Concise table of the rest of religions

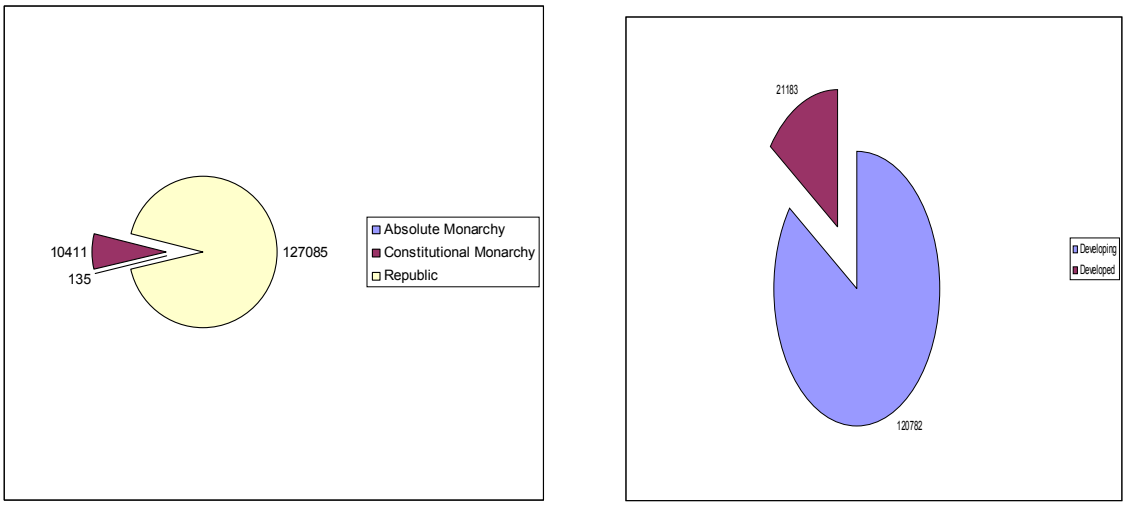
	Attacks	**Fatalities**	**Wounded People**
Armenian Apostolic	20	31	69
Evangelical	58	81	109
Lutheran	103	27	98
Shintoism	390	47	6972
Ekalesian Niue	0	0	0
Seventh Day Adventist	0	0	0
Anglican	2	0	9
Animist	57	1202	736
Zionist	15	2	2

Next, we consider regimes and their effect on terrorism. Some studies argue that the system of government can be a determinant on whether a terrorist attack will take place or not. As shown in Figure 3a countries with a republic government are more likely to face a terrorist attack. Our results do agree with previous results suggesting democracy

is the main target of terrorism. However, what we need to have in mind is that most of the countries are under the republic conditions so it is not fair enough to compare them with the minority which do have monarchy, either absolute or constitutional.

Russell and Miller (1983) mentioned that the perpetrators are from the middle or upper classes. However, they mentioned nothing about the target's economic status. Figure 3b proves that developing countries are the main target of a terrorist attack. The reason may be the fact that a developing country is usually a wealthy country in natural sources, which cannot be exploited by the locals due to the lack of technology because of economic limitations. Instead, the well-developed countries have access to the latest technology on both weapons and production process.

Figure 3: Attacks per System of Government (a) and per Developing/Developed Countries (b)

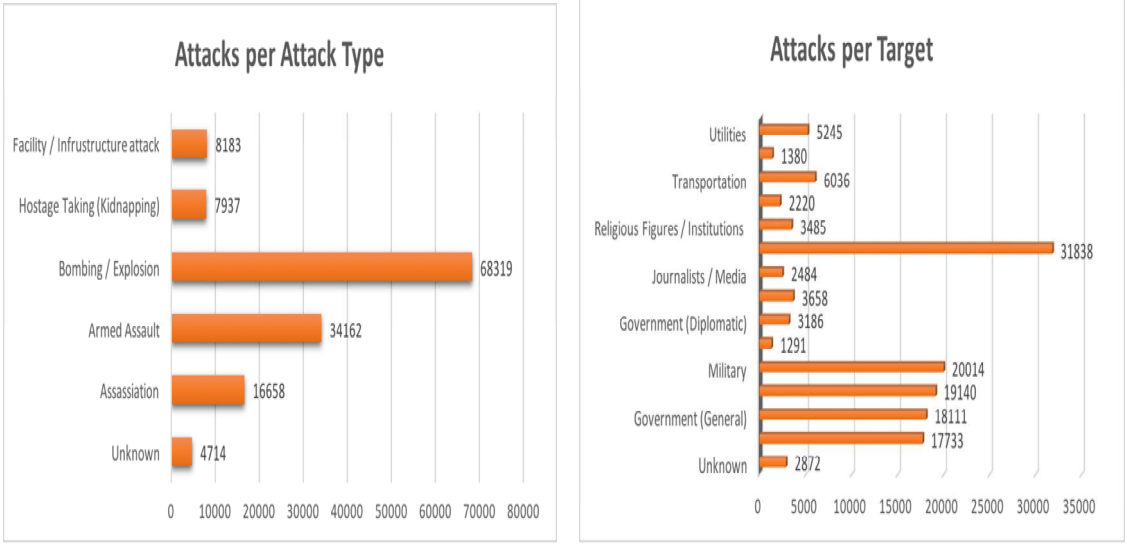


(a) (b)

Concerning the results per educational level and as we do not analyse perpetrators but the victims as a nation, we came across with a database with a great amount of missing values. Our main sources were databases of international organizations such as the World Bank, IMF and OECD. The limited amount of information has forced us not to analyse a dataset with a few observations that may lead to biased results.

Finally, Figure 4 presents the results per attack type (4a) and target type (4b) pointing out that the main weapon of the terrorists is the bombing and explosion procedure (Figure 4a). With the high-level technology, an attack caused by an explosion can create a huge impact to both fatalities and properties and is costless compared to other attack types. Figure 4b makes it clear once again, that religious fanatic are those facing the problem of terrorism. The religious figures and institutions are reaching a huge number of attacks, almost half more compared to the exactly next common target, which is the military. As a finding, we can conclude that neither the economy nor the education can cause such a disaster compared to the religious conflicts all over the world. Many crimes have been committed to the world for the God and the last year's events indicate that more events will be added into the list.

Figure 4: Attacks per attack type and target type



(a) (b)

3.3 Discussing the determinants of terrorist attacks

Now, going back to graphs and maps, we can explore the main determinants of terrorist attacks and concentrate to those that appear to be the main triggers to the assaulter's hand. Some may believe that money is what makes the world go around and the results of it can be harmful. Others may argue that the lack of education is what

makes people to be more aggressive and prone to conflicts. However, what it has been proven is that neither the economic nor the educational factors are those, which lead to great disasters.

Religion, and more specifically fanatics, is the most common determinant. This comes in line with Jones (2006). Political, economic and linguistic diversification is well accepted in the global scheme; however, religious diversification raises a lot of conflict with the holy places of worship facing the violence on its pick. Religious terrorists support the belief that they are locked in an apocalyptic battle against the demonic forces. Considering their religion as the only one that does believe and represents the real God, they try to either proselytize others or vanish the other religions. In both cases, the way to achieve their goals is painful and bloody assaults.

The second most common determinant can be the economic perspective of an attack. In other words, it is commonly observed that the economically powerful countries, which have access to the latest technological equipment, have the tendency to attack to the less developed countries that, however, are wealthy in natural resources. The less developed countries, due to their lack of technological equipment, are not able to defend their natural wealth and at the same time take advantage of it, thus they become the easy target of the superpower governments and the multinational companies. This is in line with Ojakorotu (2011) while Tavares (2004) and Arin et al. (2008) claim that targets are democratic and richer countries.

The technological advantage is not only responsible for the economically driven terrorist attacks, but also for the rapidly increased number of casualties. More specifically, the technology grows with the blink of an eye, and nowadays is more accessible than ever. Both the high level of technology as well as the quantity of

technological equipment gives access to anyone to commit a successful and very likely deadly terrorist attack.

4. The effect on economic markets: an event study analysis

As already mentioned in the literature review, one of the most common methodologies used to examine terrorist attacks is the event study analysis introduced by MacKinlay (1997). This methodology allows researchers to estimate the abnormal returns of similar events and investigate which determinants are those capable to influence abnormalities, if any exist. In these lines, we include in our research an event study analysis. In order to create the list of events we take into consideration the frequencies already presented in Section 3. These results showed that all continents, except Oceania, have a great amount of events. So, having that in mind we decided to use as a sample events from North, Central and South America, Asia, Africa and Europe. Considering fatalities as the main criterion 35 events since 1995 are examined. The list of events is presented in Table I in the Appendix.

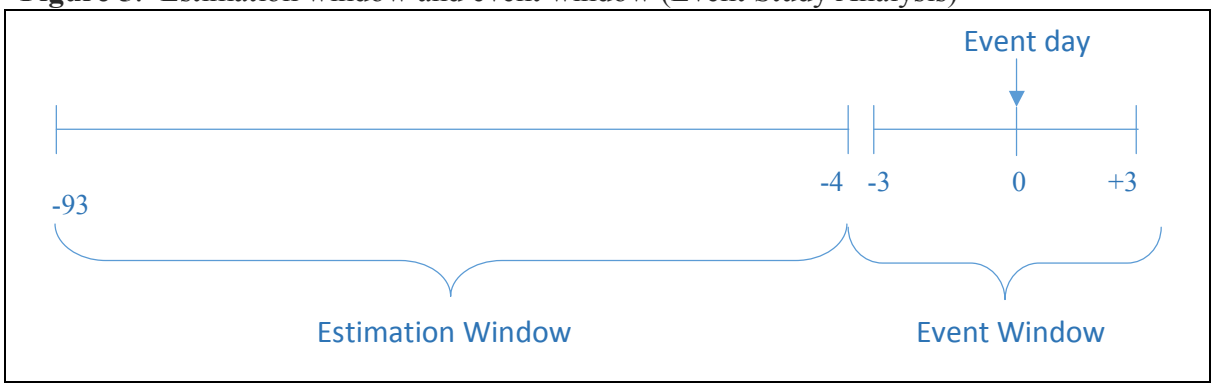
Various reasons have driven us to consider events only from the last 20 years. Specifically, based on the frequencies discussed in section 3 it was shown that terrorist attacks have rapidly increased in these years while at the same time trading nowadays is easier than ever before in the past. Moreover, an obstacle we came across is the limitations we faced on gathering the data needed. The limitation comes to the time range, due to the fact that the source[7] we used in order to have access to the price of bonds, indices and gold, could not provide the whole dataset on a daily base as required by the event study analysis.

[7] The source of data is the website Investing.com: www.investing.com

4.1 The methodology

We follow the methodology described in MacKinlay (1997) creating event and estimation windows for each event. Figure 5 illustrates both windows with the days' specification. As day zero (0) is mentioned the event day, while a 7-days event will be created as a 3-days pre-event and a 3-days post-event observations having as a middle observation the day of the event. The estimation window includes 90-days pre-event observations and it is used to estimate the coefficient of the economic and market models.

Figure 5: Estimation window and event window (Event Study Analysis)



Having created both windows, we calculate the returns required by the economic and market models. As economic model, the Capital Asset Pricing Model (CAPM)[8] formulation is used as presented in equation (1) while the market model's expression is presented in equation (2). That is

$$CAPM: \quad (R_{A,t} - R_{F,t}) = \beta(R_{M,t} - R_{F,t}) + \varepsilon_t \qquad (1)$$

$$Market\ Model: \quad R_A = \beta_0 + \beta_1 R_M + u_t \qquad (2)$$

In both approaches, $\mathbf{R_A}$ stands for Returns of the Asset, with asset in our case being the government bonds[9]; $\mathbf{R_M}$ corresponds to the Returns of the Market, being the major index

[8] Alternatively, the Arbitrage Pricing Model (APM) may be used but due to limitations in availability of data in multiple risk factors, we have used the CAPM, despite the questionable validity of the restrictions imposed by its specification. Additionally assuming the CAPM holds the constant term is expected to be zero (Gujarati, 2003).

[9] The methodology of event study analysis proposes to examine the abnormal returns of stocks. However, this paper investigates terrorist attacks that can influence the whole country. For that reason, instead of

of each country; and ε_t, u_t the disturbance terms with the usual properties. In the CAPM model specification, $\mathbf{R_F}$ stands for Returns of the Risk-free Asset. The literature proposes government bonds when investigating stocks as a risk free asset. However, in our case the government bond cannot be treated as a risk free asset because this is the main asset of investigation. Based on Barro and Misra (2016) gold can be considered as a risk free asset due to the fact that it cannot be used a hedge against macroeconomic declines and its expected real rate of return should be close to risk free.

The expression used to calculate actual returns is the following:

$$Actual \quad \text{Return} = \frac{P_t - P_{t-1}}{P_{t-1}} \tag{3}$$

where P_t stands for the closing price of period t, while P_{t-1} stands for the closing price of the previous period.[10]

The actual returns calculated for the 90-days estimation window are used in the model specifications (equations 1 and 2) from which the coefficients that will be derived are going to be used in order to calculate the expected returns in the 7-days event window. The same formula used to calculate actual returns of the 90-days estimation window will be also used to calculate actual returns in the 7-days event window, while the coefficients derived from the CAPM and Market models will be used to estimate the expected returns. Equation 4 presents the ways Abnormal Returns have been calculated, while Equation 5 presents the final step providing us with the Cumulative Abnormal Return. This is the dependent variable we try to model in order to examine whether there is a significant abnormal return, negative or positive, or not after a terrorist attack. This

stocks we have decided to calculate the abnormal returns of government bonds with the possible associated limitations.

[10] We have also tried First Difference of Logarithms specification, with all results being statistically insignificant in all cases. The formula for this specification is: $Actual\ Return = \ln P_t - \ln P_{t-1}$

variable will also be explained by a variety of explanatory variables whose significance will be taken into consideration.

$$Abnormal\ Return\ =\ Actual\ Return\ -\ Expected\ Return \qquad (4)$$

$$Cumulative\ Abnormal\ Return\ \left(C.A.R.\right) = \sum_{i-1}^{n} Abnormal\ Return \qquad (5)$$

The Simple Hypothesis Test is going to provide information about the significance of the Cumulative Abnormal Returns. The null hypothesis states that the mean value of the variable is insignificant, while the alternative hypothesis states that the mean value of the variable is significant. Alternatively, we can say that we examine if there is a significant impact on the bond returns due to the terrorist attack or not.

The final part of the analysis estimates regression models in which Cumulative Abnormal Returns (C.A.R., Y_i in expression 6) is the dependent variable with a number of independent variables modeling its behavior like fatalities of each event (X_i)_ and various dummy variables (D_i) with subscript i representing different characteristics, such as the religion (Muslim, Roman Catholic, Orthodox, Buddhist, etc), regimes, credit rating and level of development of the country. In this regression model, we have included dummies affecting both the constant term and the slope. That is

$$Y_i = \alpha_1 + \alpha_{2i} \sum D_i + \beta_1 X_i + \beta_{2i} \sum (D_i X_i) + v_i \qquad (6)$$

Where v_i the disturbance term; α_{2i} are the differential intercepts in the additive form distinguishing between intercepts in two characteristics (one belonging in a category and one not) while β_{2i} correspond to interactive or multiplicative dummies distinguishing between slopes in two characteristics (belonging or not in a category).

4.2 Empirical results and discussion

In this section we present and discuss the results derived from the methodology described. Table 3 presents the abnormal returns for each event on a 7 days event window as well as the cumulative abnormal returns for each of the 35 events with 3 days before

Table 3: Abnormal and cumulative abnormal returns based on CAPM specification and for a 7day window

Day	Event 1		Event 2		Event 3		Event 4		Event 5	
	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R
-3	-0.0053	-0.0053	0.0164	0.0164	0.0240	0.0240	-0.0047	-0.0047	-0.0121	-0.0121
-2	0.0024	-0.0029	0.0000	0.0163	-0.0687	-0.0447	-0.0249	-0.0296	-0.0071	-0.0191
-1	0.0029	0.0000	0.0121	0.0284	-0.0061	-0.0508	-0.0210	-0.0507	0.0180	-0.0012
0	-0.0016	-0.0015	0.0314	0.0598	0.0000	-0.0508	0.0000	-0.0507	0.0041	0.0029
1	-0.0007	-0.0023	0.0055	0.0653	0.0158	-0.0350	-0.0031	-0.0538	-0.0194	-0.0165
2	-0.0031	-0.0054	0.0058	0.0711	-0.0081	-0.0431	-0.0121	-0.0659	0.0109	-0.0056
3	-0.0014	-0.0068	0.0107	0.0818	-0.0091	-0.0522	-0.0041	-0.0701	0.0379	0.0323
	Event 6		Event 7		Event 8		Event 9		Event 10	
	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R
-3	-0.0320	-0.0320	-0.0175	-0.0175	-0.0122	-0.0122	0.0122	0.0122	-0.0179	-0.0179
-2	0.0204	-0.0116	-0.0080	-0.0255	0.0057	-0.0065	-0.0036	0.0087	0.0146	-0.0033
-1	-0.0127	-0.0243	-0.0020	-0.0276	0.0031	-0.0034	-0.0088	-0.0001	-0.0163	-0.0196
0	0.0000	-0.0243	-0.0266	-0.0542	0.0005	-0.0030	0.0003	0.0002	-0.0380	-0.0576
1	0.0165	-0.0078	-0.0013	-0.0554	-0.0042	-0.0072	-0.0589	-0.0587	-0.0126	-0.0703
2	0.0073	-0.0004	0.0013	-0.0542	-0.0028	-0.0100	-0.0087	-0.0673	-0.0012	-0.0715
3	-0.0061	-0.0065	-0.0111	-0.0653	0.0127	0.0027	0.0208	-0.0465	-0.0002	-0.0716
	Event 11		Event 12		Event 13		Event 14		Event 15	
	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R
-3	-0.9849	-0.9849	-0.0013	-0.0013	-0.0009	-0.0009	0.0008	0.0008	0.0072	0.0072
-2	0.0124	-0.9725	-0.0137	-0.0150	0.0016	0.0008	0.0030	0.0038	0.0111	0.0184
-1	-0.0218	-0.9943	0.0001	-0.0149	-0.0055	-0.0047	-0.0009	0.0029	0.0237	0.0421
0	-0.0138	-1.0081	-0.0047	-0.0196	0.0038	-0.0009	0.0001	0.0029	-0.1218	-0.0797
1	0.0046	-1.0034	0.0225	0.0029	-0.0040	-0.0049	-0.0013	0.0016	-0.0056	-0.0852
2	-0.0250	-1.0284	0.0057	0.0087	-0.0179	-0.0228	-0.0061	-0.0045	0.0009	-0.0844
3	0.0190	-1.0094	-0.0768	-0.0681	-0.0091	-0.0319	-0.0009	-0.0054	-0.0042	-0.0885
	Event 16		Event 17		Event 18		Event 19		Event 20	
	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R
-3	0.0059	0.0059	0.0465	0.0465	-0.0108	-0.0108	0.0140	0.0140	-0.0012	-0.0012
-2	0.0183	0.0242	-0.0568	-0.0103	-0.0001	-0.0109	-0.0187	-0.0046	0.0024	0.0012
-1	-0.0039	0.0203	0.0633	0.0530	-0.0010	-0.0118	0.0000	-0.0047	0.0043	0.0055
0	0.0000	0.0203	-0.0429	0.0101	-0.0246	-0.0364	-0.0045	-0.0092	0.0000	0.0055
1	0.0040	0.0243	0.0486	0.0588	0.0135	-0.0229	-0.0045	-0.0137	-0.0005	0.0050
2	-0.0061	0.0182	-0.0261	0.0326	0.0039	-0.0190	-0.0493	-0.0629	-0.0072	-0.0021
3	0.0047	0.0229	0.0030	0.0356	0.0108	-0.0082	-0.0011	-0.0641	0.0006	-0.0015
	Event 21		Event 22		Event 23		Event 24		Event 25	
	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R
-3	0.0160	0.0160	-0.0011	-0.0011	-0.0077	-0.0077	0.0053	0.0053	0.0077	0.0077
-2	-0.0139	0.0021	-0.0026	-0.0036	-0.0099	-0.0176	-0.0032	0.0021	0.0036	0.0113
-1	0.0031	0.0053	-0.0035	-0.0072	-0.0219	-0.0396	0.0053	0.0073	-0.0005	0.0107
0	-0.0006	0.0046	-0.0002	-0.0074	0.0061	-0.0335	-0.0122	-0.0048	-0.0112	-0.0004
1	-0.0005	0.0041	0.0016	-0.0057	0.0197	-0.0137	0.0428	0.0380	-0.0065	-0.0069
2	-0.0199	-0.0158	-0.0069	-0.0127	0.0001	-0.0137	0.0071	0.0451	0.0038	-0.0031
3	-0.0019	-0.0176	-0.0072	-0.0199	0.0129	-0.0008	0.0209	0.0660	-0.0035	-0.0066
	Event 26		Event 27		Event 28		Event 29		Event 30	
	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R
-3	0.0327	0.0327	0.0055	0.0055	0.0057	0.0057	0.0028	0.0028	0.0035	0.0035
-2	0.0118	0.0445	-0.0207	-0.0152	0.0152	0.0209	-0.0021	0.0007	0.0182	0.0216
-1	-0.0069	0.0376	-0.0017	-0.0169	-0.0039	0.0170	0.0007	0.0014	0.0094	0.0310
0	-0.0150	0.0226	0.0324	0.0156	-0.0009	0.0161	-0.0035	-0.0021	0.0002	0.0312
1	-0.0144	0.0083	0.0116	0.0272	0.0024	0.0185	0.0108	0.0087	0.0140	0.0452
2	-0.0055	0.0028	-0.0072	0.0200	0.0086	0.0271	0.0041	0.0128	0.0157	0.0609
3	-0.0113	-0.0085	-0.0150	0.0050	-0.0067	0.0204	0.0002	0.0130	0.0040	0.0649
	Event 31		Event 32		Event 33		Event 34		Event 35	
	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R	A.R	C.A.R
-3	0.0091	0.0091	-0.0066	-0.0066	0.0040	0.0040	-0.0028	-0.0028	0.0008	0.0008
-2	0.0074	0.0165	-0.0065	-0.0131	-0.0132	-0.0093	0.0017	-0.0011	-0.0025	-0.0017
-1	-0.0165	0.0000	-0.0165	-0.0296	0.0065	-0.0028	0.0424	0.0413	-0.0157	-0.0174
0	0.0000	-0.0001	0.0080	-0.0217	0.0124	0.0096	0.0178	0.0590	0.0006	-0.0169
1	0.0153	0.0152	0.0132	-0.0085	0.0132	0.0229	-0.0299	0.0291	0.0003	-0.0165
2	0.0047	0.0199	0.0129	0.0044	-0.0106	0.0123	0.0011	0.0303	-0.0096	-0.0261
3	0.0034	0.0233	0.0070	0.0115	-0.0098	0.0026	0.0068	0.0371	0.0092	-0.0169

and after the terrorist attack.[11] The aggregation of the abnormal returns is required so that we can draw the overall impact of the events included in the analysis. One of the assumptions is that one event window is not overlapping with another event window on the same market. The absence of overlapped event windows leads to independent abnormal returns across the events.

Regarding event day zero, the day when the terrorist attack occurred, some events appear to have zero abnormal returns. This can be justified because either the attack occurred after the close of the stock markets or the attack occurred on a day the stock markets do not open such as weekends. In these cases, the impact of the attacks will be captured in the abnormal return of day one. Such examples could be events three, six, sixteen, twenty and thirty-one.

Table 4 presents the results from the Simple Hypothesis Test for both Cumulative Abnormal Return Variables. From Table 4 in both cases the null hypothesis is not rejected as P-values are greater than usual levels of significance (α=0.1, 0.05 or 0.01). In other words, we cannot reject the null hypothesis, thus we do not know if the events cause an impact on the bond returns or not.

Table 4: Simple Hypothesis Test Results

Cumulative Abnormal Return	t-statistics	p-value
CAPM	-1.209411	0.2348
Market Model	-1.0743657	0.2905

Next, we discuss the results from the Cumulative Abnormal Returns regressions. Table 5 summarizes the results derived from the regressions, which provide information about the determinants of abnormalities. The first column of the table presents the independent variables used in the regression as determinants and the second column presents the coefficients from the initial CAPM specification. The third column presents the coefficients from the CAPM model after omitting the insignificant variables. Finally,

[11] Abnormal returns based on the market model and estimations of returns of a 90-days window are not presented here but are available on request.

the fourth column presents the initial results from the market model specification. Some of the variables initially decided to be included, such as credit rating, were omitted due to colinearity problems.

As shown in Table 5, after the initial attempt to determine the coefficient for the Cumulative Abnormal Returns calculated with CAPM, we omitted the insignificant variables to end up in a more accurate result. The same attempt been tried for the market model as well, but the estimation could not be improved by omitting insignificant variables.

Thus, moving forward to the discussion of those results it is important to mention that all the models have a high Goodness of Fit as shown by the adjusted R^2, which in all cases is greater than 95%. This actually means that in all cases the explanatory variables can describe more than 95% of the Cumulative Abnormal Returns. Concerning the diagnostic tests there is no indication in any of them apart from normality in the case of the market model.[12] Discussing the determinants, we should mention that as it is proven by the frequencies in section 3 the religion is a great determinant in a terrorist attack and at the same time appears to be a significant determinant in the abnormal returns as well.

More specifically Muslim, which had the greatest amount of terrorist attacks, is a significant determinant to the abnormalities as well. Regarding the signs of the coefficients, a positive sign indicates an increase on the Cumulative Abnormal Return. Bringing in mind equation 4, the increase of Abnormal Returns actually indicates the increase in the spread between the actual and the expected price, or a decrease otherwise. However, this cannot indicate if this increase is a positive or negative abnormality. On the other hand, the decrease of the abnormality, a smaller negative sign of the coefficient, indicates that the actual price is close to the expected price. Having that in mind, we can

[12] For details on diagnostic tests see Halkos (2006, 2011).

conclude that the developed countries and the countries with a republic system of government appear to have fewer abnormalities when terrorist attacks occur due to the negative sign of their coefficients.

Table 5: Cumulative Abnormal Returns (C.A.R.) in CAPM and Market Models

Variables	C.A.R. CAPM	C.A.R. CAPM	C.A.R. Market Model
Constant	0.154920 (1.9431) [0.0662]	0.200070 (2.9859) [0.0066]	0.182157 (2.8367) [0.0093]
Fatalities	0.009797 (1.1632) [0.2584]	-1.67E-05 (-1.4471) [0.1614]	-6.53E-06 (-0.5917) [0.5599]
Protestant	0.058545 (0.9220) [0.3675]		
Roman Catholic	0.204683 (3.2118) [0.0044]	0.150472 (3.6159) [0.0015]	0.103923 (2.6059) [0.0158]
Buddhist	-0.086692 (-1.1160) [0.2776]	-0.131558 (-2.3960) [0.0251]	-0.159613 (-3.0333) [0.0059]
Orthodox	-0.100825 (-1.4522) [0.1620]	-0.148581 (-2.7618) [0.0111]	-0.192885 (-3.7412) [0.0011]
Muslim	-0.134710 (-1.8716) [0.0760]	-0.181642 (-3.170118) [0.0043]	-0.187059 (-3.4066) [0.0024]
Republic	-0.076472 (-2.8220) [0.0105]	-0.073866 (-2.8378) [0.0093]	-0.019333 (-0.7750) [0.4462]
Developed	-0.141016 (-2.615) [0.0166]	-0.129068 (-2.5298) [0.0187]	-0.148506 (-3.0374) [0.0059]
Fatalities Muslim	-0.009210 (-1.0940) [0.2870]	0.000595 (2.3774) [0.0261]	0.000270 (1.1270) [0.2714]
Fatalities Orthodox	-0.009514 (-1.1296) [0.2720]	0.000299 (2.6241) [0.0152]	0.000220 (2.0111) [0.0562]
Fatalities Buddhist	-0.009786 (-1.1611) [0.2593]		
Fatalities Christian	-0.010877 (-1.3909) [0.1795]	-0.001829 (-2.0167) [0.0556]	-0.002337 (-2.6883) [0.0131]
Fatalities Roman Catholic	-0.044748 (-5.1138) [0.0001]	-0.034738 (-21.6906) [0.0000]	-0.029643 (-19.3140) [0.0000]
Fatalities Protestant	-0.009813 (-1.1651) [0.2577]		
Adjusted R^2	96.464%	96.715%	95.542%
Akaike Info Criterion	-3.700444	-3.805767	
Normality	1.1664 [0.5581]	1.0838 [0.5816]	39,884 [0.0000]
ARCH effect	0.1412 [0.7096]	0.3032 [0.5351]	0.1874 [0.6680]
Breusch-Pagan	0.1818 [0.8352]	0.0953 [0.9095]	0.2813 [0.7576]
Ramsey RESET	0.3980 [0.6951]	0.0823 [0.9352]	0.6971 [0.4930]

t-statistics in parentheses and p-values in brackets

In the case of the CAPM model specification and in analyzing the coefficients, it is important to take into consideration both the use of additive and multiplicative dummies. More specifically, when an event occurs in a country which major religion is Muslim, the effect caused by the Muslim victims to the abnormality equals to 0.018428 (0.200070-0.181642), while the influence on the slope of fatalities equals to 0.0005783

(-.67E-05+0.000595). In the same way, we can estimate the effects caused when the event victims are Roman Catholics or Orthodox. In the case of Orthodox the constant term also decreases to 0.051489 (0.200070-0.148581) as in Muslim and the effect on slope decreases as well and equals to 0.0002823 (-1.67E-5 + 0.000299).

On the other hand, the case of Roman Catholics differs from the previous cases, where, the constant term is influenced in a way that increases the total effect from 0.200070 to 0.350542 (0.200070 + 0.150472) and the effect on the slope is higher and equals to -0.0347547 compared to -1.67E-05 that is the slope of the fatalities. In some cases, the religion dummy can influence only the constant term or the slope and not both of them. Such cases are the Buddhist, Republic and Developed variables, which only influence the constant term by decreasing it to 0.068512, 0.126204 and 0.071002 respectively. A variable that influences only the slope of fatalities is the Christian religion, which leads to an influence of -0.0018457 when fatalities occur in a Christian country. If none of these cases occurs and the religions are different, then the constant influence on the Cumulative Abnormal Returns equals to the constant term (0.200070) and the influence of the fatalities equals to -1.67E-05.

To conclude with, the event study analysis has indicated that although we are not able to conclude whether the Cumulative Abnormal Return is significant and has an impact or not, determinants do exist and can describe the increase or decrease of the spread between the Actual and the Expected Return. To our knowledge, it is the first time the religions of the victims are included into the analysis and the regressions showed that their impact is also significant. Moreover, we have proven that the more democratic and developed countries tend to decrease the spread on the returns.

5. Conclusions

The purpose of the paper was to analyze briefly terrorist attacks and their main determinants. For this reason, we have used a worldwide dataset since 1970 and tried to extract some terrorist determinants and reasoning if any behind. Relying on a statistical description and mapping, we have tried to come into conclusions as a first level of a more advanced approach. Then in order to explore possible effects on economic markets an event study was carried out. Most of our empirical ascertainments are in line with previous researches.

Overall, based only on statistical findings, we proved that the main reason of a terrorist event is religion. Moreover, the level of diversification, such as in the European case, can cause great conflicts. In particular, religions and especially fanatics is the most common determinant followed by the economic perspective of an attack. We have shown that the more democratic and developed countries are inclined to decrease the spread on the returns and have found the perspective of the market reaction due to those events.

Supplementary research requires an extension on the time span when feasible. More specifically, we would like to include into the sample the events of 2015–2016, which have raised a lot of attention from all over the world, but they have not been included into the databases yet. Another improvement will be to search for other relative explanatory variables available in a daily frequency to receive a more spherical result of each situation. This will be strengthening by the use of the appropriate bond indexes instead of major indexes used here due to our limited access to historical data. Finally, the examination of individual firms and sectors suffered from the terrorist attacks and the consideration of their stock market values before and after the terrorist events may help us to infer further on this matter.

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Appendix

Table I: List of Events

Date	Continent	Country	Government Bond	Index	Fatalities
19/4/1995	America	USA	30 years	Nasdaq	168
17/3/1997	Europe	Belgium	20 years	BEL 20	4
11/9/2001	America	USA	30 years	Nasdaq	2952
17/3/2007	America	Mexico	10 years	IPC	10
6/3/2008	Asia	Israel	10 years	TA 25	9
5/7/2009	Asia	China	20 years	CTSP300	184
29/3/2010	Europe	Russia	15 years	MICEX	40
9/9/2010	Europe	Russia	15 years	MICEX	18
18/8/2011	Asia	Israel	10 years	TA 25	5
22/8/2012	Asia	Turkey	5 years	BIST 100	21
31/1/2013	America	Mexico	10 years	IPC	37
11/5/2013	Asia	Turkey	5 years	BIST 100	53
19/8/2013	Africa	Egypt	10 years	EGX 30	25
21/9/2013	Africa	Kenya	10 years	NSE 20	72
20/11/2013	Africa	Egypt	10 years	EGX 30	11
29/12/2013	Europe	Russia	15 years	MICEX	36
16/5/2014	Africa	Kenya	10 years	NSE 20	48
22/5/2014	Asia	China	20 years	CTSP300	36
23/5/2014	Europe	Ukraine	2 years	PTFS	20
14/6/2014	Europe	Ukraine	2 years	PTFS	49
23/6/2014	Africa	Egypt	10 years	EGX 30	22
4/7/2014	Asia	Saudi Arabia	1 year	TASI	6
8/7/2014	Asia	Israel	10 years	TA 25	5
17/7/2014	Europe	Ukraine	2 years	PTFS	298
28/7/2014	Asia	China	20 years	CTSP300	96
28/7/2014	Asia	Israel	10 years	TA 25	6
31/7/2014	Asia	Israel	10 years	TA 25	5
5/8/2014	Africa	Egypt	10 years	EGX 30	22
31/8/2014	Europe	Ukraine	2 years	PTFS	87
24/10/2014	Africa	Egypt	10 years	EGX 30	34
3/11/2014	Asia	Saudi Arabia	1 year	TASI	7
6/11/2014	Europe	Ukraine	2 years	PTFS	201
13/11/2014	Europe	Ukraine	2 years	PTFS	20
18/11/2014	Asia	Israel	10 years	TA 25	7
16/12/2014	Asia	Pakistan	30 years	FTSE	157